Breeding for yield generally aims at recovery of transgressive segregates. All the interspecific crosses had thrown a good number of transgressive segregates for kapas yield per plant ranging from 29 to 67% in the F_2 generation. Similar trend has been repeated in F_3 generation also for this character along with number of bolls per plant.

Highest number of transgressive segregates in the F_3 generation for yield per plant was observed in the intraspecific crosses of Mdl 1874 and Mdl 2450 with the testers PA - 141 and PA-183. Amongst intraspecific crosses Mdl 2452 x PA-183 and Mdl 2450 x PA-141 were promising because in addition to yield per plant these crosses expressed transgressive segregates for important yield associated with fibre components in both the generations.

Transgressive segregates in the F_2 may arise due to dominance and dominance interactions in addition to additive x additive interaction which is fixable, due to recombination of genes with positive effects and responsible for the production of transgressive segregates in the F_3 generation. The findings, therefore, also revealed that the parents differed for many genes and introgression of genes from herbaceum germplasm lines created large amount of genetic variability for yield and fibre components in most of the crosses suggesting the scope to use this material and the crosses in future breeding programme. Similar results were also reported in lentil by Kant and Singh (1998).

The crosses which gave high frequency of transgressive segregates for yield per plant accompanied with desirable fibre properties in both the generations may be preferred over the other crosses in on-going breeding programme.

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(Received : June 2002; Revised : January 2003)

Madras Agric. J. 90 (1-3) : 154-157 January-March 2003

Research Notes

Heterosis for rooting characters in maize (*Zea mays* L.)

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Maize occupies a pride of place among coarse cereals in India. About 80 per cent of the maize belt being rain dependent, experience vagaries of weather interms of either water logging or drought. Several researchers have suggested that breeding for improved root systems in annual crops such as cereals and grain legumes could significantly improved their yield under drougth (Hurd, 1976 and Blum, 1982). Turner *et al.* (1978) stated that the variation in root growth between species determines differences in drought tolerance. Utilisation of genetic variation in improving crop varieties requires knowledge of the heritability, heterosis and genetic control of root system traits. Present study involves the estimation of heterosis for number of roots, root length and root dry weight in 15 crosses of maize hybrids.

Six outstanding maize inbreds viz. UMI 112, UMI 285, UMI 130, UMI 467, UMI 810 and UMI 90 were chosen as parents, based on grain yield with good agronomic characteristics but differing in genetic background. These lines were crossed in all possible combinations, excluding reciprocals, resulting in deriving of 15 hybrids. The root potential of the six parents and fifteen F_1 progenies were evaluated in the greenhouse

Table 1. Mean and heterosis for root number, length and root dry weight in maize

Inbred/Hybrid	No.of roots	Root length (cm)	Root dry weight (g)	Heterosis % over No. of roots		Root length		Root dry weight	
				MP	BP	MP	BP	MP	BP
UMI 112	50	30.4	8.92	-	-	-	-	-	-
UMI 285	25	19.2	11.56	-	-	-	-	-	-
UMI 130	58	32.4	7.45	-	-	-	-	-	-
UMI 467	52	29.5	11.90	-	-	-	-	-	-
UMI 810	53	28.9	12.12	-	-	-	-	-	-
UMI 90	27	27.5	9.65	-	-	-	-	-	-
UMI 112 x UMI 285	36	27.4	10.52	21.06*	-25.92*	22.98*	-14.43*	-4.8	-13.2
UMI 112 x UMI 130	30	26.5	8.21	-15.92*	-38.27*	-2.87*	-17.24*	-22.4*	-32.1*
UMI 112 x UMI 467	51	28.4	9.68	-10.98	4.94*	1.84*	-11.30*	7.8*	-20.4*
UMI 112 x UMI 810	66	37.5	17.20	-11.96	35.80*	2.87*	17.11*	90.2*	42.8*
UMI 112 x UMI 90	40	28.9	12.81	17.42*	-17.69*	5.35*	-9.74	25.3*	5.7*
UMI 285 x UMI 130	62	36.0	8.90	10.30*	27.51*	18.22*	12.43*	-24.2*	-26.6*
UMI 285 x UMI 467	34	24.8	7.92	17.92*	-30.04*	25.26*	-22.55*	-23.0*	-30.6*
UMI 285 x UMI 810	30	25.8	17.80	16.40*	-38.27*	26.82*	-19.42*	91.2*	72.4*
UMI 285 x UMI 90	58	35.8	16.80	74.61*	19.34*	30.62*	11.80*	84.0*	30.2*
UMI 130 x UMI 467	46	30.2	12.32	-17.45*	-5.35	-1.45*	-5.68	18.2*	1.7
UMI 130 x UMI 810	40	29.2	9.14	-18.20*	-17.69*	-0.49	-8.81	-2.6	-24.6*
UMI 130 x UMI 90	42	30.0	8.70	6.82	-13.58*	1.84*	-6.31	-24.0*	-28.2*
UMI 467 x UMI 810	69	39.2	18.24	-13.90*	41.98*	4.45*	22.42*	94.6*	69.6*
UMI 467 x UMI 90	39	29.5	11.72	14.94*	-19.75*	7.02*	-7.81	14.5*	-3.3
UMI 810 x UMI 90	38	28.4	10.28	13.50*	-21.81*	8.19*	-11.36*	-12.3	-15.2
Mean of Inbreds	44	27.9	10.27	-	-	-	-	-	-
Mean of Hybrids	45	30.5	12.02	-	-	-	-	-	-
SEd	2.9	2.3	1.45	-	-	-	-	-	-
CD (5%)	5.8	4.5	2.89	-	-	-	-		

* - Significant at 1% level ; MP - Mid Parent ; BP - Better Parent

using black colored polythene bags of 110 cm. long and 23 cm. diameter. These bags were filled wth well-sieved and fumigated soil. The experimental unit comprised of two seedlings of each genotype per bag. A randomised block design with two replications was adopted. Plants were watered during critical periods i.e. flowering, cob formation and milking stages. After flowering of all entries, the roots of plants were washed by gentle spray of water to remove the soil from them. Observations on number of roots and root length were taken from both parents and hybrids. The roots recovered from each genotype was oven dried and the dry weight of roots were recorded. The heterosis percentage was calculated over mid and better parent for all the three parameters (Gowen, 1952).

Significant difference between genotypes (parents and hybrids) was observed for number of roots, root length and root dry weight (Table 1). The number of roots in the parents ranged from 25 (UMI 285) to 58 (UMI 130). Among the hybrids, UMI 467 x UMI 810 recorded the maximum number of roots (69). The parental mean was 44, while that of hybrid was 45. The heterosis for number of roots ranged from -18.20 (UMI 130 x UMI 180) to 74.61 (UMI 285 x UMI 90) over the mid parental value. Eight hybrids registered significant positive heterosis, while four surpassed the mid parental value in the negative direction. Range of heterobeltiosis was from -38.27 to 41.98 per cent. Five hybrids recorded significant heterosis in the positive direction, while nine hybrids in the negative direction. Breeding for improved root systems significantly improve their yield under drought. Both root proliferation and depth of penetration are important characteristics for drought tolerance. Among the parents, a wide variation for root length was observed with the value ranging from 19.2 cm (UMI 285) to 32.4 cm (UMI 130). The hybrid UMI 467 x UMI 810 recorded the maximum root length of 39.2 cm. which exceeded the hybrid mean value of 30.5 cm. Eleven hybrids were observed to have highly significant positive heterosis for root length which was ranged from -2.89 to 30.62 over mid parental value. Heterobeltiosis to a minimum of -22.55 and a maximum of 22.42 was observed. Four hybrids were found to have significant heterosis in the positive direction.

Mean root dry weight varied from 7.4 (UMI 130) to 12.12 g (UMI 810) in pare and 8.21 g (UMI 112 x UMI 130) to 18.2 (UMI 467 x UMI 810) in hybrids. Three inb lines viz. UMI 810, UMI 467 and UMI 2 and four hybrids viz. UMI 467 x UMI 8 (18.24 g), UMI 285 x UMI 810 (17.80 UMI 112 x UMI 810 (17.20 g) and U 285 x UMI 90 (16.80 g) comparatively produc greater root mass. Heterosis over mid-paren value for root dry weight ranged from -2 (UMI 285 x UMI 130) to 94.6 per cent (U 467 x UMI 810) and eight out of fifte hybrids manifested significant, mid-parent heterosis in the positive direction. Hetero over the better parent for this trait varied fro -32.4 (UMI 112 x UMI 130) to 72.4 p cent (UMI 285 x UMI 810). Among fift hybrid combinations, only six crosses recor significant, positive heterosis over better pare Crosses such as UMI 285 x UMI 810, UM 467 x UMI 810, UMI 112 x UMI 810 an UMI 285 x UMI 90 showed higher parent heterosis of 72.4, 69.6, 42.8 and 30.4 p cent respectively for root dry matter productio Differences in root volume in maize genotype have also been recorded by Musick *et al.* (1965 and Thompson (1968). Spencer (1940) note larger differences between inbred lines of maiz in the rate of development of lateral root and in the ratio of top to root dry weigh of seedlings. Evaluation of these experimenta inbreds under water stress conditions showed that selection for larger root weight was usefu in increasing grain yield under mild water stress, while selection for increased root length was superior under severe stress. Increased root mass resulted from greater density of roots or depth of root growth which would facilitate increased extraction of soil water and maintenance of higher plant water potential to avoid effects of drought.

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(Received : December 2001; Revised : January 2003)

Madras Agric. J. 90 (1-3) : 157-159 January-March 2003

:search Notes

'roduction potential of coconut hybrids and their parents in relation › physiological parameters

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Ever since the hybrid vigour was observed .n 1932 in coconut, the increased potentiality .s being exploited by the production of hybrid :oconuts involving tall and dwarf varieties. Patel (1937) observed that the maximum vigour was obtained in coconut hybrid when the tall variety was used as female and dwarf as the male parent. High degree of allogamy does not permit to obtain genetically pure talls by inbreeding. Therefore the hybrid seedlings are to be chosen carefully in the nursery, so as to eliminate future trees with poor combination of physiological characters. Physiological and biochemical characters such as enzyme activity, chlorophyll content, photosynthetic rate, leaf area and dry matter production are the dependable characters and can be exploited to screen vigorous progenies in the nursery. Shivasankar and Ramadasan (1983) obtained a high positive correlation between nitrate reductase activity and annual nut yield in coconut genotypes. There is not much work has been reported in physiological aspects.

Hence, the present study was undertaken at Coconut Research Station, Veppankulam during 1995 to 1999 in three talls (East Coast Tall, Cochin China, Laccadive Ordinary), three dwarfs (Malayan Orange Dwarf, Malayan Yellow Dwarf, Malayan Green Dwarf) and five hybrids (ECT x MGD, ECT x MYD, ECT x MOD, CC x LO, and LO x CC).

The youngest unfolded leaf (i.e) 11th from the top sampled for apparent photosynthesis (Mathew and Ramadasan, 1974). Chlorophyll content and nitrate reductase activity were studied from the 14th leaf (Mathew and Ramadasan, 1973, Shivasankar and Ramadasan, 1983). The photosynthetic and respiratory rates were estimated by using LCA (ADC, UK). Chlorophyll content was determined spectro-photometrically using the method of Malkinney (1941). The soluble protein (Lowery *et al.* 1951) and nitrate reductase activity (Hageman and Huchlleshby, 1971) were also determined in the leaf samples.